Environmental Trends in the Georgia Basin, British Columbia

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The Georgia Basin is diverse in its ecology, in its landscape and in its people. In the past 25 years, the population has doubled, and in the next 15 years it may double again, creating enormous pressures on the environment, on society and on the economy. The Georgia Basin Ecosystem Initiative is a framework for action, whereby agencies collectively offer their mandates and their goals to address the environmental challenges confronting the Basin. The BC Ministry of the Environment, Lands and Parks is a partner in this initiative. We present here six environmental indicators for the Georgia Basin. Four of these indicators are accompanied by secondary measures that provide more details about the issue. The BC Ministry of the Environment, Lands and Parks is a lead agency reporting on the state of the environment.

These indicators, along with supporting technical documents, may also be viewed on the BC Ministry of the Environment, Lands and Parks, State of Environment Reporting web site at: http://www.elp.gov.bc.ca/sppl/soerpt.

Status and Trends of Protected Areas in the Georgia Basin

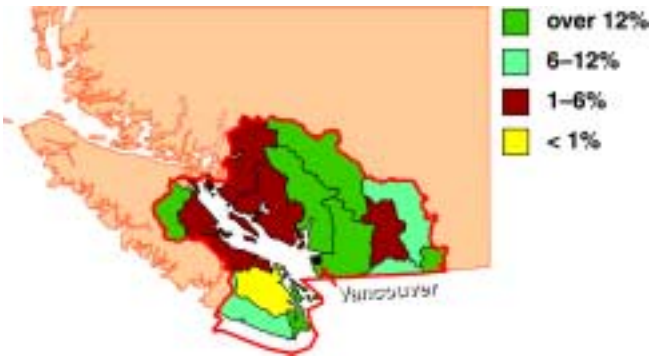

Figure 1 Percentage of protected land area by watershed group in the Georgia Basin.
Source: BC Land Use Coordination Office and Ministry of Enviroment Lands and Parks, 2000. Notes: The delineations represent watershed groups in the Georgia Basin, as described in the British Columbia Watershed Atlas.

- As of 2000, 700,000 ha in the Georgia Basin were protected, comprising 257 protected areas—about 14.6% of the basin land area.
- Five of the six watershed groups depicted in the "over 12%" category in Figure 1 have more than 20% of their area protected.

- In this indicator, areas that are managed mainly for the conservation of natural diversity and to maintain ecosystem integrity that meet the criteria for Categories I to III as defined by the World Conservation Union (IUCN) were included. These are ecological reserves, class A and C parks, recreation areas, national parks, protected areas that fall under the *Environment and Land Use Act*, Regional Parks, National Wildlife Areas as well as private land holdings for conservation purposes. Not included are Migratory Bird Sanctuaries, Provincial Wildlife Management Areas and urban recreational parks.
- 38 protected areas include a small amount of marine waters within their boundaries and a further 69 are adjacent to marine waters.

Why is it important?

- In British Columbia, protected areas are one key element of a strategy to protect the province's biological and cultural heritage.
- The protected areas network also provides outdoor recreation opportunities.
- Protected Areas contribute to the maintenance of ecosystems, species and genetic resources.

What is being done?

- The British Columbia Protected Areas Strategy was initiated in the early 1990s, to protect representative areas of biological and cultural diversity, provide habitat protection for wildlife, protect recreational resources, and to provide opportunities for scientific research and education.
- As of 2000, 12% of the provincial land base is now protected through the Protected Areas Strategy.
- The Pacific Marine Heritage Legacy is a five-year federal/provincial program to protect areas in the Southern Gulf Islands.
- Within the framework of the Pacific Marine Heritage Legacy, a Federal-Provincial Marine Protected Area Strategy is being developed to guide the establishment of marine protected areas. These areas will protect marine habitats and their species for conservation of biodiversity, protection of economically important stocks, and for recreational, cultural, and historical values and scientific and educational opportunities.
- Non-government land conservancy organizations continue to play a key role in the identification and acquisition of protected areas in the Georgia Basin. A special trust fund for private contributions has been established as part of the Pacific Marine Heritage Legacy.

How big are protected areas in the Georgia Basin?

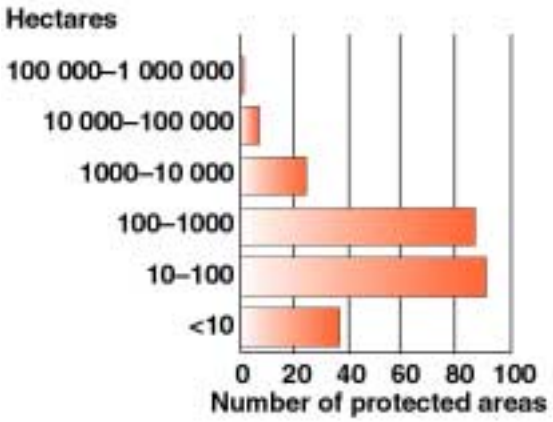

Figure 2. Size frequency of 246 protected areas in the Georgia Basin. Sources: B.C. Land Use Coordination Office and BC Ministry of Environment, Lands and Parks 2000

- An ecological debate exists as to the relative value of large versus small protected areas and their ability to sustain biodiversity.
- Eighty-four percent of protected areas are 1000 hectares or smaller in size, less than 1% are 100,000 hectares or larger.

Status and trends in species at risk in the Georgia Basin

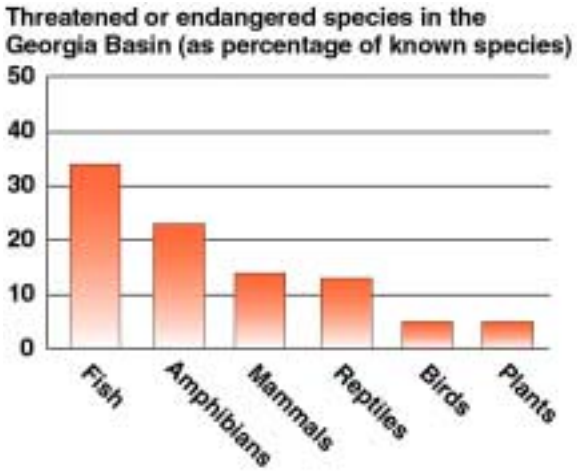

Figure 3. Threatened and Endangered species, as a percentage of known indigenous species on the Georgia Basin. Source: BC Ministry of Environment, Lands and Parks, 2000. Conservation Data Centre. Notes: Plants are restricted to vascular plants. Total threatened or endangered species/native breeding species by group is: freshwater fish 14/41; amphibians 3/13; reptiles 1/8; birds 8/163; mammals 10/73; vascular plants 73/1367. Species at risk are designated as: endangered when they are facing imminent extinction or extirpation; threatened when they are likely to become endangered if factors affecting their vulnerability are not reversed; or vulnerable when they are of special concern because of characteristics that make them particularly sensitive to human activities or natural events.

- Thirty-six vertebrate species of 298 in the Georgia Basin are either threatened, endangered, or candidates for these designations. These include the spotted owl, marbled murrelet, and the Vancouver Island marmot.
- An additional 32 vertebrates are considered vulnerable, including Roosevelt elk, Sandhill crane and the great blue heron.
- Besides these species that breed in the Georgia Basin, there are 9 threatened or endangered bird species and 14 vulnerable bird species for whom the region provides critical wintering and migratory stop-over habitat.
- The marbled murrelet and the Oregon spotted frog are recent additions to the endangered and threatened species list, added in 1996.
- Seventy-three of 1367 native vascular plant species in the Georgia Basin are considered threatened or endangered.
- An additional 83 native vascular plants are vulnerable.
- There are 554 introduced plant species in the Georgia Basin accounting for 86% of all introduced plants in the province.

Why is it important?

- The diverse array of habitats in the Georgia Basin support a large number vertebrate species that breed, winter and make migratory stop overs in the basin. Diverse and viable populations of wild plants and animals are an important part and of a healthy ecosystem. Long-term economic and social well being for people depends on a healthy ecosystem.
- Impacts to habitat from urban development and agriculture pose serious threats to species at risk in the Georgia Basin.

What is being done?

- British Columbia is committed to the National Accord for the Protection of Species at Risk. All provinces have agreed to protect species and their habitats and develop recovery plans for nationally designated threatened or endangered species. The National Accord emphasizes preventative measures, stewardship initiatives and the need for partnerships on both public and private lands.
- British Columbia will respect prohibitions and implement recovery plans as outlined in the proposed federal *Species at Risk Act*.
- The Protected Areas System is the cornerstone of the province's initiatives to protect species at risk. It sets aside important habitats, with conservation and recreation as management objectives.
- There are several successful partnerships and programs such as the Lower Mainland Nature Legacy for conserving wildlife habitat through park designation and the Pacific Coast Joint Venture for conserving waterfowl, shorebirds and other wetland dependent wildlife species.

Where are threatened and endangered vertebrates found in the Georgia Basin?

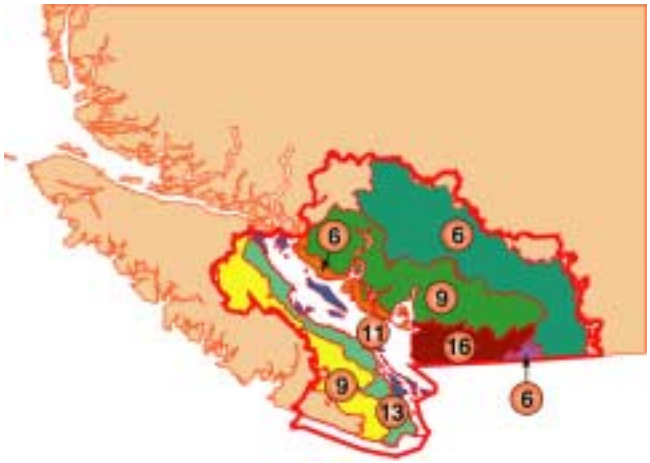

Figure 4. Number of threatened and endangered species occurring in ecosections of the Georgia Basin. Source: BC Ministry of Environment, Lands and Parks, 2000. Conservation Data Centre. Notes: Circled numbers indicate the total number of threatened or endangered vertebrates species present in each ecosection (a species may occur in several ecosections).

- The Fraser Valley and the coastal lowlands of east Vancouver Island have the highest numbers of threatened or endangered species (29 species).
- These areas also have the highest densities of human population in the Georgia Basin and are expected to continue to grow. Loss and degradation of habitat in these areas from human activities remain challenges.

Status of Surface Water Quality

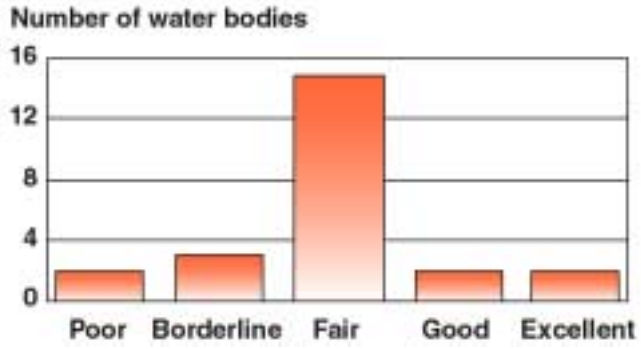

Figure 6. Water quality among monitored water bodies in the Georgia Basin. Source: BC Ministry of Environment, Lands and Parks, 2000. Water Management Branch. Notes: The ratings are derived from a Provincial Water Quality Index (WQI), which measures the impact of pollutants on water quality. Since the WQI is based on sampling in areas where there are likely to be water quality concerns, the results may indicate a poorer state than if a random sampling of all water bodies in the Georgia Basin was considered. Individual indices are determined by the number of water quality objectives not met and the frequency and amount by which these objectives are exceeded. Data for the WQI were taken from 24 water bodies in the Georgia Basin (including fresh surface streams, rivers and lakes, and marine areas) for which at least three years of data were collected between 1992 and 1997.

Water Quality Index Definitions:
Excellent: Conditions very close to natural or pristine. All uses are protected and none are threatened or impaired.
Good: Conditions rarely depart from natural or desirable levels. All uses are protected, with only a minor degree of threat or impairment.
Fair: Conditions sometimes depart from natural or desirable levels. Most uses are protected, but a few are threatened or impaired.
Borderline: Conditions often depart from natural or desirable levels. Several uses are threatened or impaired.
Poor: Conditions usually depart from natural or desirable levels. Most uses are threatened, impaired or even lost

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- Regular monitoring for the attainment of water quality objectives is conducted on a small percentage of waterbodies in the Georgia basin where water quality problems are most likely to occur.
- The number of waterbodies monitored annually fluctuates based on available resources. Between 1992 and 1997 the number of waterbodies monitored in the basin ranged from a high of 21 in 1994 to only 5 in 1997.
- 24 waterbodies in the Georgia Basin, including 7 marine waterbodies with at least 3 years of data collected between 1992 and 1997, were included in this analysis. Almost 2/3 of these received a Fair ranking, indicating some degree of impairment.
- The high percentage of water bodies with ratings of Fair or below, indicates there is a need for vigilant monitoring as well as actions to prevent further degradation and costly restoration.
- 5 of the monitored waterbodies received Poor or Borderline rankings.

Why is it important?

- Protecting drinking water quality and maintaining the integrity of aquatic and marine ecosystems are important environmental issues for British Columbians.
- British Columbia has 25% of the flowing freshwater in Canada.

What is being done?

- Nonpoint source contamination is a significant and growing source of water pollution. The Provincial Government has developed a Nonpoint Source Pollution Action Plan as a key step to address this problem.
- Efforts to reduce the impacts of industrial effluent and agricultural run-off are being addressed through pollution prevention plans and the agricultural code of practice.
- Upgrades to sewage treatment facilities and the implementation of liquid waste management plans continue to help reduce the impacts of residential sewage. Successful examples include upgrades at the Annacis and Lulu Island plants, which discharge into the Lower Fraser River. Both plants have been upgraded from primary to secondary treatment.
- Water quality for fish is being addressed through the *Watershed Restoration Program*, the *Fish Protection Act* and the *Forest Practices Code*. The *Fish Protection Act* provides tools to protect water for fish. Some tools are being used such as the streamside directive have recently been enacted; others such as Watershed Management Plans have not yet been enacted.
- An inventory program funded by Forest Renewal BC has been established to protect drinking water quality from the impacts of forestry in eight high priority community watersheds.

Status and Trends in Groundwater Supply in the Georgia Basin

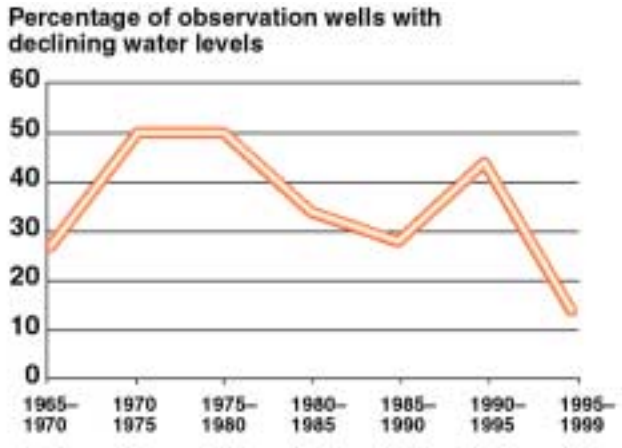

Figure 7. Percentage of observation wells with declining water levels in the Georgia Basin from 1965 to 1999. Source: BC Ministry of Environment, Lands and Parks, 2000. Water Management Branch. Notes: Number of sampled wells with suitable long-term trend data increased from 11 of 12 in 1965 to 69 of 72 in 1999.

- Only 14% of observation wells had declining water levels between 1995 and 1999. Of these, four are on the east coast of Vancouver Island, three are on the Gulf Islands and three are in the Fraser Valley.
- This occurred despite a growing population and demand for groundwater.
- Long-term trends in groundwater levels are currently monitored in 72 observation wells in the Georgia Basin.
- The percentage of observation wells with declining water levels increased from 27% in 1965 to 50% percent during the period 1970 to 1980.
- Climatic factors are the principle agents affecting groundwater levels in the Georgia Basin.

- Precipitation replenishes groundwater supplies. Between 1980 and 1999, normal and above normal precipitation resulted in an overall decrease in the percentage of observation wells with declining water levels.

Why is it important?

- Groundwater is an important source of water for domestic use and for agriculture and industry.
- Excluding Greater Vancouver and Greater Victoria, groundwater sources supply approximately 38% of the municipal water demand in the Georgia Basin. This estimate does not include water use in rural areas.
- Groundwater contributes to the year-round base flow for fish-bearing streams and wetlands.

What is being done?

- The government is currently examining non-regulatory approaches to groundwater protection such as encouraging local government agencies and water purveyors to develop well and aquifer protection plans.
- Regular inspections of agricultural activities in the Fraser Valley are made by regional staff between November and February to ensure storage and disposal of manure are done in accordance with the code of practice for agricultural wastes.
- Monitoring of nitrate levels is ongoing at 20 wells in the Abbotsford-Sumas Aquifer.
- Enhancements are being made to groundwater inventory activities.

Where is groundwater demand highest in the Georgia Basin?

Figure 8. Number and location of heavily used aquifers in the Georgia Basin. Source: BC Ministry of Environment, Lands and Parks, 2000. Water Management Branch.

- A map-based system has been developed to classify groundwater reservoirs (aquifers) and assess the risks to water quality and demands on supply.
- As of 2000, there are 174 Georgia Basin aquifers in the inventory. Of these, twelve are heavily used. These are located on southeast Vancouver Island and in the Fraser Valley.
- While supplies of groundwater are clearly under stress in these aquifers, heavy use can also put the quality of water at risk. This is the case in some coastal areas of the Gulf Islands and Saanich Peninsula on Vancouver Island where excessive water withdrawal has caused salt-water intrusions into aquifers.

Is groundwater susceptible to contamination in the Georgia Basin?

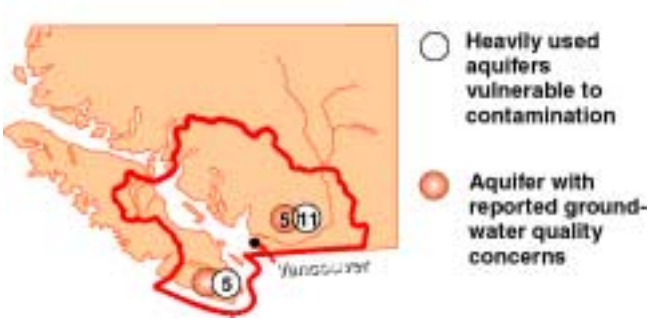

Figure 9. Number and location of heavily used aquifers vulnerable to contamination and aquifers with water quality concerns in the Georgia Basin. Source: BC Ministry of Environment, Lands and Parks, 2000. Water Management Branch. Notes: 1. Each circle represents one aquifer of concern within the given area unless otherwise indicated by numbers. 2. The BC Water Quality Status Report, 1996, describes in more detail the state of water quality in some aquifers. 3. Most information is collected in areas of highest population density.

- Eleven aquifers in the Fraser Valley, five on southeast Vancouver Island and the Gulf Islands have reported water quality concerns. Many of these supply drinking water to communities.
- Five aquifers in the Lower Mainland and one aquifer on southeast Vancouver Island are identified as heavily used and highly vulnerable to contamination.
- Groundwater sources are replenished by surface waters and precipitation. Contaminants on the ground and in the air are carried in rainwater and snowmelt into surface waters and may eventually be transported into groundwater.
- Septic tank treatment and effluent disposal in septic fields, agricultural use of fertilizers, herbicides and pesticides, are potential sources of contaminants in groundwater.
- Contamination may also come from such sources as landfills and infiltration ponds for municipal and industrial waste.

Status and trends in inhalable particulates in the Georgia Basin

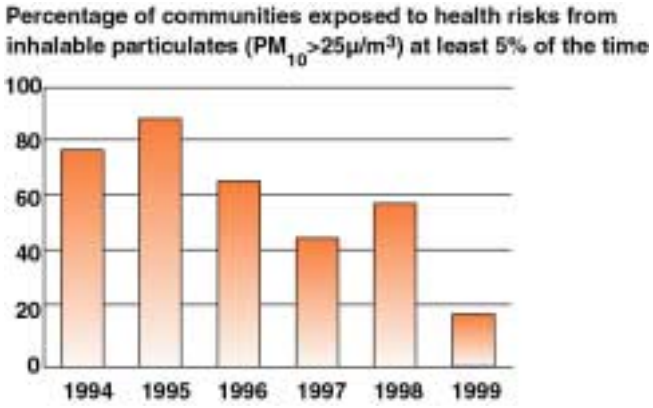

Figure 10. Percentage of communities in the Georgia Basin exposed to health risks from inhalable particulates (PM10>25µg/m3) at least 5% of the time. Source: Ministry of Environment, Lands and Parks, Air Resources Branch, 2000. Notes: This indicator depicts the percentage of sampling stations annually where PM10 was greater than 25 micrograms/m3, the concentration above which health risks begin to occur, for at least 5% of the time in each year. Data were taken from two types of sampling stations continuous and non-continous. Non-continuous samplers take samples once every six days. Only stations with data for 75% of the hours in at least 11 months of the year were included. The total number of stations meeting these requirements were: 1994, 9; 1995, 9; 1996, 12; 1997, 13; 1998, 12; 1999, 16. Monitoring sites are often present in communities where air quality is a concern, therefore the data do not reflect the average air quality throughout the Georgia Basin.

- In 1999, 3 of 16 communities monitored in the Georgia Basin exceeded the inhalable particulate level (PM_{10}) at which health effects are known to occur (25 µg/m^3), at least 5% of the time.
- Weather affects the amount of particulates suspended in the air. Particles are dispersed by winds and carried to the ground in raindrops.
- Higher than average wind speeds and rainfall contributed to low concentrations of airborne particulate matter in 1999.
- Particulate Matter (PM) includes solid and liquid particles, such as dust, dirt, soot, exhaust, smoke and liquid droplets, that are directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and naturally windblown dust.
- Particles can also form in the air from the chemical transformation of directly emitted gases such as sulphur dioxide, nitrogen oxides and various hydrocarbons and ammonia.
- PM is divided into classes depending on size. In general, the smaller sized particles pose the greatest health risk. $PM_{10.}$ Particles of 10 micrometres or less in diameter (PM_{10}) (about one-eighth the width of human hair) pose a health risk. Health concerns arise when concentrations exceed 25 micrograms of particles per cubic metre of air.
- Recent scientific investigations have shown that $PM_{2.5}$, particles 2.5 micrometres or less, poses the greatest health risk. $PM_{2.5}$ is a subset of PM_{10}. As data become available; future indicators will present $PM_{2.5.}$

Why is it important ?

- Inhalable particulates can pose a serious threat to public health. PM_{10} and smaller can to be inhaled deeply and penetrate the respiratory system. There they affect breathing, aggravate existing respiratory and cardiovascular disease, damage lung tissue and contribute to cancer and premature death.

- $PM_{2.5}$ is a major component of "smog" and contributes to reduced visibility, which leads to negative impacts on safety, aesthetics, business and tourism.

What is being done?

- Air Quality is a major concern and efforts to control emissions are being made by all levels of government in the Georgia Basin.
- Several programs and activities have been initiated to improve air quality. These include: the development of air quality management plans in the Greater Vancouver Regional District and in the Fraser Valley Regional Districts; AirCare, an ongoing activity to reduce motor vehicle emissions in the Lower Fraser Valley (LFV); a heavy vehicle testing program in the LFV; modernization of air monitoring programs; Smoke Control Regulations such as the regulation of large-scale open burning and higher standards for wood stoves.

Where are the risks to health from inhalable particulates (PM_{10}) in the Georgia Basin?

Figure 11. Percentage of time PM10 exceed 25ug/m3 at each monitoring station in the Georgia Basin in 1999. Source: BC Ministry of Environment, Lands and Parks, 2000. Air Data and Monitoring System Database. Notes: The dark portion of the pie graphs shows the percentage of time in 1999, at each sampling station, that PM10 exceeded 25 micrograms/m3, (i.e., levels above which health effects can occur). The white pies represent data taken from continuous samplers and the dark pies represent data taken from non-continuous samplers (i.e., one sample every six days).

- Recent scientific evidence indicates that negative health effects from PM_{10} can occur when outdoor concentrations rise above 25 micrograms per cubic metre.
- Most at risk are individuals with chronic obstructive pulmonary or cardiovascular disease, asthmatics, the elderly and children.
- Air quality concerns are not restricted to large communities. Topography, air circulation, precipitation, settlement patterns and local industries all affect the amount of inhalable particulates measured in a community.
- Levels of inhalable particulates in the Georgia Basin are generally better than in communities of concern in the rest of the province.
- Of the 16 sampling stations in 1999, 10 represent communities in the Lower Mainland. The remaining six, represent Squamish, Powell River, Campbell River, Quadra Island, Duncan and Victoria. These communities were exposed to health risks from inhalable particulates between .3 and 24% of the time.

Sources of inhalable particulates in the Georgia Basin

- There are 3 broad categories of sources, Mobile, Point and Area. In the Lower Mainland portion of the Georgia Basin, mobile sources from cars and other modes of transportation account for 26% of primary or direct PM_{10} emissions. The remaining 74% of PM_{10} emissions are equally divided between the remaining two categories—point sources (i.e., emissions for which permits have been issued) and Area sources (i.e., small business and residential).

Status and trends of domestic solid waste in the Georgia Basin

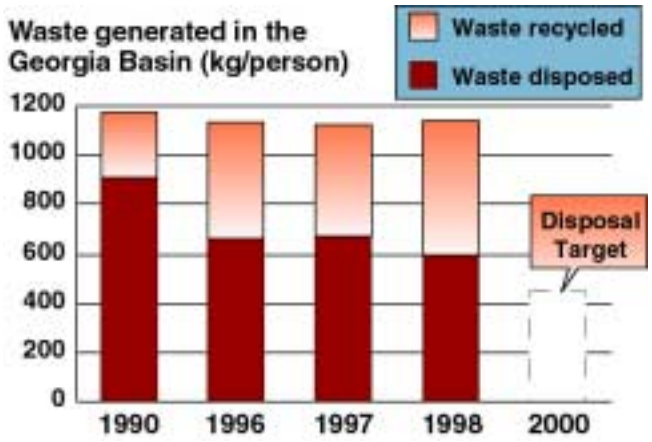

Figure 12. Per capita waste disposed and recycled in the Georgia Basin in selected years between 1990 and 1998. Source: BC Ministry of Environment, Lands and Parks, 1999. Pollution Prevention and Remediation Branch. BC Municipal Solid Waste Tracking Report 1997-98. Notes: Estimates for recycled and disposed wastes were derived from municipal surveys conducted across British Columbia. Survey methodology was improved in 1996, increasing the reliability of the data. Estimates of recycled waste are likely underestimated as private recycling facilities and recyclables collected by industry stewardship programs are not included.

- In 1998, 3.4 million tonnes of solid waste was generated in the Georgia Basin; 1140 kg of solid waste per person. Per capita waste generating has remained fairly constant since 1990.
- Since 1990, however, increasing amounts of waste has been diverted to recycling facilities.
- Just over half the solid waste generated in 1998 was disposed of in landfills or burned in municipal incinerators. This represents a 34% reduction in waste disposed per person since 1990.
- In 1998 about 540 kilograms of solid waste per person was diverted to recycling facilities. Waste recycled has increased from 23% of total waste generated in 1990 to 47% of total waste generated in 1998.
- Recycling has been so successful in the Georgia Basin that even with an 18% increase in population between 1990 and 1998 the total amount of waste disposed decreased from 2.1 million tonnes in 1990 to 1.8 million tonnes in 1998.
- The provincial target is to reduce the amount of solid waste disposed per person by about 50% of the 1990 rate by the end of 2000. This requires a further 16% reduction in the amount disposed per person in the Georgia Basin.

Why is it important?

- In 1998, 3.4 millions tonnes of waste was produced in the Georgia Basin alone, about 50% of that was disposed of in landfill sites or burned in municipal incinerators.

- Landfill sites consume valuable land, are a significant source of greenhouse gases and can contribute to groundwater contamination. These factors make landfills unappealing to most communities and the task of finding new landfill sites very difficult.
- Although modern incinerators produce much lower levels of pollutants than older incinerators, they still emit acid gases, carbon dioxide, toxic chemicals and fine particulates. These contaminants make their way into air, water and eventually into local food chains.

What is being done?

- Domestic and industry stewardship programs coupled with government programs are ensuring that the most hazardous components of solid waste are disposed of safely. The existing programs include (data initiated):
    - Lead-acid batteries and scrap tires (1991)
    - Used lubricating oil (1992)
    - Paint residuals (1994)
    - Pharmaceuticals, solvents, flammables, pesticides, and gasoline residuals (1997)
    - Beverage containers (1998)